



AGRICULTURE MARKET INFORMATION SYSTEM: A CRITICAL REVIEW OF LITERATURE

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ABSTRACT

In first decade of 21st century reforms in agricultural markets were introduced in several developing countries of the world including improvement in tangible infrastructure as well as non-tangible reforms like farmer trainings, establishment of Agriculture Marketing System etc. The need for establishment and improvement of current Agriculture Market Information system (AMIS) for collection and dissemination was severely felt in 2007-08 after food crisis. This paper aims to review and evaluate the literature available on AMIS published from 1995 to 2018 showing the utility of market information and its impact on different stakeholders especially in developing countries. The use of AMIS, its components, working, economic utility of information for its different stakeholders like growers, policy makers and market functionaries and the challenges like cost involved, validity of data, accuracy and problems in its disseminations are reflected in this article. Review of literature findings showed that AMIS is useful tool to enhance the capacity of stakeholders for appropriate planning and timely decision making. Growers get assistance from AMIS in enhancing their bargaining power and improving market opportunities through timely availability of reliable market information while traders/ market functionaries benefit by knowing latest prices of agriculture commodities and availability trends for sale and purchase of produce. By improving the quality of collected data, its meaningful interpretation, timely dissemination and proper understanding and execution policy makers can increase the benefits for all the stakeholders of value chain.

KEYWORDS: Agriculture; marketing information; price collection; traders; dissemination; Pakistan.

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INTRODUCTION

Defining Agriculture Marketing System (AMIS)

Currently, ICT mediated agriculture is based on agriculture extension services lead by market forces (Santosh *et al.*, 2015). Agricultural Market Information System (AMIS) is planned for collection of agriculture information, analysis and dissemination on situation and status of the prices of agricultural commodities. Developed countries are using it since long while developing countries started its development after 1980 but not fully developed in spite of being pioneers (Mawazo *et al.*, 2014). Bhutta *et al.* (2019) explained the factors affecting the performance of market committees in Punjab. Coulter and Poulton in 2001 described it as a mandatory element of the evolution process of agriculture development. The development of AMIS in early 1980 was an indicator towards globalization and liberalization of markets dealing especially in staple food by promoting the scope of private sector and limiting the role of public sector marketing entities (Inter-reseaux, 2008). However, some newly developed AMISs also cover horticultural and livestock related commodities. Originally AMISs were designed by the state

organizations with extensive support of funding agencies. While twenty first century is evident that a lot of private enterprises have developed their AMIS cells just like Reuters Market Light in India, Esoko in Africa and similar services working in other countries of world demonstrating the commercial and economic viability of the service. In fact market information in some OECD (Organization for Economic Co-operation and Development) countries is believed as public right similar to Market News Service controlled by USDA (United State Department of Agriculture). There are two primary objectives of AMIS, first to improve public policies through reliable data exposing the market realities and secondly allocation of resources through market transparency (Galtier *et al.*, 2013). However, providing latest or up-to-date material for commercial use is considered as prime objective of AMIS which subsequently is used by both value chain players and decision makers in public and private sector (Shepherd, 1997).

Use of AMIS

The uses of agriculture information system can be defined on need for information like short run (where,

when at what price) or in long run (what and when to plant) for public sector, which commodity to support and subsidies. The beneficiaries of AMIS may include educational institutions, consumers, farmers, farmer cooperatives, food processors, policy analysts, market wholesalers, policy makers, extension workers and researchers (Kizito, 2011). Different organizations have different uses of market information with varying use of technology (Binayee, 2005). AMIS build the bargaining power of farmer for negotiation of his produce for sale. While traders use information to efficiently dispose his produce. AMIS is also used to provide factual input for assessment of food security through price fluctuating trends and detecting the areas of food shortage and ultimately issuing food security alerts (David-Benz *et al.*, 2011). Javed *et al.* (2015) conducted a research regarding rice export from Pakistan and found that information related to export and price have positive impact on the local deals of rice which showed increasing price trend benefiting the growers. The farmers can market their produce with use of mobile application without involvement of middleman (Abishek and Bhagyalakshmi, 2016). With use of cloud based application marketing of agriculture produce can be facilitated through forecasting, data analysis and dealing with stakeholders (Abimannan *et al.*, 2014). The middleman had monopoly in prevailing system of marketing due to their easy access to market information and marketing infrastructure (Iqbal *et al.*, 2009).

Rationale of Study

The need for establishment and improvement of current Agriculture Market Information system (AMIS) for collection and dissemination was severely felt in 2007-08 after food crisis and in response marketing

reforms including establishment of AMIS in several countries happened. Several studies have been found which were conducted on individual country’s AMIS but not a single study which evaluate the working of AMIS of developing and developed countries. The aim of this review paper is to evaluate the literature available on agriculture marketing system and the worked already published especially in developing countries.

MATERIALS AND METHODS

To review the literature on the topic about 28 studies were scrutinized out of 200 articles browsed from Elsevier, Emerald, Science Direct, Google scholar, E-publications and different reports of world organizations published from 1995 to 2018. Initially, “agriculture marketing information, Agriculture information, agriculture marketing system, agriculture marketing service” was used as keyword to browse and resulted 200 articles. Based on the constructs use of agriculture information, its contents, utility, value and collection, processing and dissemination procedure and challenges only 50 articles were identified. Only 28 articles were systematically analyzed which were published in high impact factors journals having top citations. These articles present the evaluated working of agriculture marketing information in developing and developed world. The use of AMIS, its components, working, economic utility of information for its different stakeholders like growers, policy makers and market functionaries and the challenges like cost involved, validity of data, accuracy and problems in its dissemination are reflected in these articles (Fig. 1).

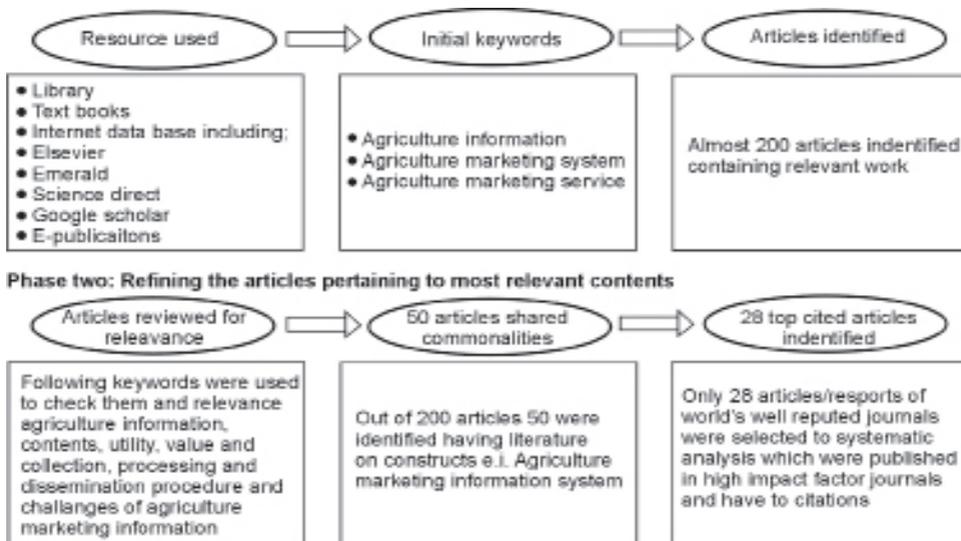


Fig. 1. Articles selection procedure

Limitation

Due to limited resources the current study has analyzed only 28 top ranked articles while many more are also there which can reflect a detailed picture on the given topic and elaborate the scenario in better way.

Background:

Initially well managed efforts were made by the developing countries to operationalize AMIS in which government institution collects only price data and disseminates it to electronic and print media for awareness of stakeholder (Shepherd, 1997). According to David-Benz *et al.* (2011) and Galtier *et al.* (2014) a single model was the base of the first generation AMIS without consideration of market, product type and concerned country. Mostly it only covers single category of produce by focusing only on price which just rely only on development project based funding by donor agencies run by government bodies including different ministries and marketing boards. Principally, AMIS should be operated by statistical divisions rather than ministries.

AMIS is defined in various ways like FAO describes it "The facility operated by state sector which comprise price collection on regular basis and quantity supplied of a few agricultural commodities which are frequently used from the wholesale agricultural produce markets, feeder markets and retail markets and dissemination of that data through various means like (bulletins, televisions, round ups, newspapers, SMS etc.) farmers and policy makers and market functionaries (Shepherd and Schalke, 1995).

Initially AMIS experienced various challenges. According to Bowbrick (1988), market information was spatial arbitrage having poor data collection, non-reliable quality of information with little concern about grade. He further elaborated agriculture ministries have low resources for AMIS which has high cost. According to a survey of various AMISs of developing countries it was found that inaccurate information was provided to the farmers with a considerable lag to be practical use. Governments collect the data from different location and involve huge investment. Majority of information systems have statistical display rather than its use for commercial one. Most of the AMIS obsolete after completion of project life or stop of donor assistance or partially working which is not different till now (Shepherd, 1997).

World Bank (2011) criticized the AMIS run by the state institutes due to inaccuracy of information and lack of timeliness causing poor economic impact of information. The data is poorly collected and analyzed. The major criticism imposed by the World Bank was delayed dissemination of information to the growers

while the working of AMIS of Indonesia which was established after a detailed research and run by GTZ serving agriculture marketing chain was found improved (Schubert *et al.*, 1988). The invention of mobile phones and internet have put AMIS in new generation through improvement of ICT which has reduced both time and cost for transmission of information to farmer community. It also has revolutionized the real time collection of information. AMIS using ICT is now called "Second Generation AMIS" or 2 G AMIS (David-Benz *et al.*, 2011; David - Benz *et al.*, 2012; Galtier *et al.*, 2014).

Now a day's real time data is available not only on price but also on supply, production, trade (import and export, contacts of buyers and sellers) and government policies. The current generation AMIS system are also providing complementary services like risk management, storage facilities, credit links and warehouse receipt system (CTA, 2013) and commodity exchanges markets (Mukhebi and Kundu, 2014; Katangeza, 2012).

Galtier *et al.* (2012) described the strength of AMIS powered by ICT which included improvement in supply information to cater the real needs of stakeholders, facilitating the stake holders to use the information and linking the AMIS to further allied systems and improving data dissemination.

Timely availability of accurate and appropriate information is key input for an effective early warning setup on nutritional security. The price information is used by the several organizations to create relationship between food security and Consumer price Index (CPI) (Dubey and Gennari, 2004).

Previous studies on marketing information system:

There are many studies that have been conducted within the world on AMIS. Although, most of the studies have been outdated but still they are carrying pretty useful information. They still provide necessary input for establishment of new AMIS systems and improving the existing one like Mendoza (2006) working in Market Information Organization of the Americas which enlisted 24 best systems (MIOA, 2006) and measured MIOA members according to these criteria. Some of the best practices recognized among them were following:

1. The rules and norms have been established to ensure the authentication of the information collected Mendoza (2006).
2. A suitable amount of budget is allocated to perform the strategic activities (Mendoza, 2006).
3. Relevant literature from proper / suitable sources is used as a basis for activities of data collection.
4. There are different manuals regarding processing

- and analysis of data and the staff is competent enough to use them (MIOA, 2006).
5. An up to date and purposively fit software programs are being used with the capability to modify the program.
 6. The reports generated as easy to produce and are simple to understand (David-West, 2010).
 7. The staff and other human resource is trained enough to further promote the service.
 8. The generated reports are disseminated to the suppliers of data and up-to-date office record of this distribution of information is maintained.
 9. The classification of users & consumers of information is made according to their chosen mode of distribution.
 10. The access to MIS's website is easy and informal and the website is always up-to-date (Alabdulkader *et al.*, 2017).
 11. There is a strong feedback mechanism and procedures for this purpose are laid down (Alabdulkader *et al.*, 2017).

Mabota *et al.* (2003) assessed the working of AMIS in Mozambique and Mawere (2008) evaluated the AMIS in Zambia. They found that the link between AMIS and commodity exchange market enhanced the accuracy and relevance and reduced the cost of data collection. Alabdulkader *et al.* (2017) explored during study of marketing of dates in Saudi Arabia that availability of prevailing prices has significant contribution in marketing margins.

In view of the conclusion of these studies, the Agriculture Market Information System (AMIS) of Punjab Government has been studied and some proposals/shortcomings have been highlighted.

DISCUSSION

David-Benz *et al.* (2016) conducted an analysis of 582 respondents in Madagascar. Different methods used for dissemination of market information were evaluated and it was found that producers had views that better access to market information is necessary for good returns on produce. They found that the farmers having market information on their cell phones have greater involvement in market but very little numbers of farmers have cell phones in their ownership. They concluded that diversified means of communications should be used to disseminate market information like radio, television announcement etc. Zoltner and Steffen (2012) evaluated different local and international AMISs in Africa including AMIS of Cameroon, the Esoko, the Info trade Market Information Services of Uganda, the Agricultural Input Market Information and Transparency System of Eastern Africa, the Livestock

Market Information System of Ethiopia, Lima Links system of Zambia, MF arm of Kenya, Nokia Life Tools of Nigeria, RATIN of Eastern Africa and the service derived by the Zambian National Farmers Union. The research assessed that even, most established AMIS had issues to deliver profitable information to growers without support of government or funding agencies. The study has concluded that already established MIS face challenges no matter how much that MIS is well established in providing market information to growers without present government, donor or institutional support. The sustainability of the services provided to farmers will be mainly dependent on the provision of those services that allow them to improve their income levels and there by providing solid justification of the fee they pay.

In Punjab, Pakistan Directorate of Economics and Marketing (E&M) has introduced AMIS system in 2005 to provide reliable information to growers. This system started initiatives like collecting information of prices of commodities, license and market fees etc. from 20 large markets of the province. A website has been launched (www.amis.pk) on which this information is being uploaded and disseminated through mobile phone messages. These are good initiatives but Ahsan 2017 investigated that the impact of these messages on the marketing of agricultural commodities is inadequate. According to his study Information is neither reliable nor timely.

The stakeholders (Ahsan, 2017) have complained that the collected and uploaded data is obsolete and outdated and it cannot be used for the purpose of conducting business. Views of none of farmer or Arthie were taken into account for executing the study of AMIS price information. They informed that they get to know about the information and fluctuations in prices of different markets from their colleagues working there. It was also pointed out that the data regarding cost of production for different crops is not latest and also incomplete. For example the data of cost of production of wheat crop (as accessed on 7th February 2019) is related to the year 2012-13 and 2013-14 only. Moreover, the outreach of AMIS initiatives is restricted. For example, the service of daily bulletin regarding prices of 10 major markets for 81 commodities is disseminated to 195 beneficiaries, and daily trends in prices along with comparison of last year for 18 commodities is disseminated to 48 recipients. (Out of which majority is of senior government functionaries) (AEM Directorate, 2017). The most widespread service is the service of text messages on phone regarding daily prices, which is spread to more than one million recipients. But the directorate of Agriculture E&M has not at all analyzed the impact of this service on all the

stakeholders including consumers and growers.

In light of above studies AMIS are overwhelmed with the many difficulties and issues in developing countries and some of these problems include;

1. More attention and focus is given to the collection of information and data on prices but a very little attention is given to dissemination of this collected information to growers for use.
2. The quality of the gathered information is generally poor and deprived and it does not efficiently show market conditions.
3. The process of collection and distribution of information is not carried out on regular basis and therefore this situation does not really assist farmers to bargain commission agents which creates indecisive situation for farmer regarding sending the produce to the market.
4. Majority of the farmers is illiterate and they cannot understand the form in which the Information is published and hence cannot read or use that information.
5. The timing of broadcasting of information via radio, Television and other allied means is inappropriate and not suitable.
6. Notice boards showing information about prices in the villages, rural areas and distinct markets are not appropriately retained and reorganized.
7. The users of the information find it difficult to use the information as the prices are quoted indicating particular varieties and quality grades.
8. The absence of proper and uniform packing Units (e.g. "boxes," "tins," "sacks") makes it difficult to report prices within a country.
9. The majority of reporting regarding price information is carried out from wholesale markets in urban areas, therefore the meanings of this information is difficult to understand for the farmers in rural and remote areas.
10. The process of collection and distribution of information is associated with prices in markets, demand and supply of agricultural commodities and other related roles of market while the services are provided to stakeholders (Mohy-ud-Din & Badar. 2011).

Theoretical and Policy Recommendations

On basis of our discussion based upon critical review of literature available on AMIS, following recommendations are submitted.

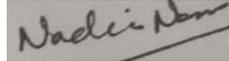
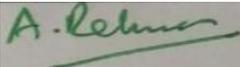
1. The common finding in most of the studies was that farmers were unable to use it due to un-awareness. Therefore, farmers should be trained to get meaningful interpretations and benefit from its usage.
2. The collection of prices data must be real time based and should be timely disseminated to the stakeholders in order to get maximum value.
3. The absence of organized and regular analysis of prices of agricultural commodities makes it difficult for policy makers to take right decisions on continuous basis. For example, latest information is missing regarding retail price spreads at farm levels, price elasticities, seasonal variations in prices and effective forecasting of prices etc. Researchers need to take into account these deficiencies to cover up in future.
4. Provision of market information along with technical assistance of farmer to choose alternative crops at the time of sowing to boost returns for their efforts.
5. Regular training and capacity building programs need to be carried out by different departments and agencies that are part of data collection process in order to bring technical efficiency and assure consistency in collection activities.
6. An effective mechanism should be applied for regular monitoring of officials and staff that are involved in reporting of price data to increase the credibility of information.
7. An efficient commodity grading system should be initiated to improve price quotations.
8. The market information related to specific commodities must be provided to specific growers having specialization in production of those crops along with complete production and post-harvest services.

REFERENCES

- Abimannan, S., C. Sujatha, T. LakshmiPriya and K. Durairaj. 2014. Cloud Based Virtual Agriculture Marketing and Information System (C-VAMIS). A paper from conference proceedings on Emerging

- ICT for Bridging the Future - Proceedings of the 49th Annual Convention of the Computer Society of India Volume 1.
- Abishek, A.G., M. Bharathwaj and Bhagyalakshmi. 2016. Agriculture marketing using web and mobile based technologies. Explored from IEEE Digital library with Accession Number: 16559936.
- Ahsan, R.M. 2018. Commissions and Omissions: Agriculture produce markets of Pakistan. Working paper 01/2018; Available online at https://www.monash.edu/__data/assets/pdf_file/0010/1428769/WP1_Rana_complete.pdf
- Alabdulkader, M.A., M. A. Elhendy, S. H. Al Kahtani, S.M. Ismail. 2017. Date marketing efficiency estimation in Saudi Arabia: A two- stage data envelopment analysis approach. *Pakistan Agri. Sciences*, Vol. 54(2):475-485.
- Bhutta, E., M. Ilyas and M. Usman. 2019. The Need For Transforming Agriculture Produce Markets: Evidence From Punjab, Pakistan. *Pak J. agri. Sci.* Vol. 56(3):767-773.
- Bhutta, E., S. Kausrar and A. Rehman. 2019 Factors affecting the performance of market committees in Punjab: An Empirical assessment of performance through Smart PLS. *J Agric. Res.*, 57(3):189-197.
- Binayee, S.B. 2005. Marketing Information System: An overview of agriculture marketing systems in South Asia. Retrieved from http://www.ansab.org/wp-content/uploads/2010/07/AgriMISSouthAsia_Report.pdf 12-03-2019.
- Bowbrick, P. 1988. Errors to avoid with price reporting systems. Paper based on Bowbrick, P. Are Price Reporting Systems of Any Use? *British Food Journal*, 90:65-9. Available at: <http://www.bowbrick.org.uk/Publications/Price%20Reporting%20System.pdf>.
- David-West, O. 2010. Esoko Networks: facilitating agriculture through technology. Case Study. UNDP Publication: New York, USA. Available at: http://growinginclusivemarkets.com/media/cases/Ghana_Esoko_2010.pdf.
- David-Benz, H., F. Galtier, J. Egg, F. Lançon and G. Meijerink. 2011. Market Information Systems: Using information to improve farmers' market power and farmers organizations' voice. Available at: <http://www.esfim.org/wp-content/uploads/policy-brief7-english.pdf>.
- Dubey, S. P. Gennari. 2014. Now-casting Food Consumer Price Indexes with Big Data: Public-Private Complementarities. Paper prepared for the International Association for Official Statistics 2014 Conference, 80-10 October 2014. Da Nang, Viet Nam. Available at: <https://www.premise.com/files/Nowcasting%20Food%20Consumer%20Price%20Indexes%20with%20Big%20Data%20Public-Private%20Complementarities.pdf>.
- Galtier, F. 2013. Managing food price instability in developing countries: A critical analysis of strategies and instruments. Joint CIRAD – Agence Française de Développement Publication. Available at: http://www.afd.fr/webdav/shared/PUBLICATIONS/RECHERCHE/Scientifiques/A_savoir/17-VA-A-Savoir.pdf.
- Inter-réseaux. 2008. Market Information systems (MIS): Effective systems for better transparency of markets. Inter-réseau x Publication. Available at: http://www.inter-reseaux.org/IMG/pdf_SIM_engl.pdf.
- Iqbal, A., I. Ashraf, S. Muhammad and K.M. Chaudhry. 2009. Identification and prioritization of production, protection and marketing problems faced by the rice growers. *Pakistan Journal Agri. Sciences*, Vol. 46(4):290-293.
- Javed, J., A. Ghafoor, A. Ali, M. A. Imran and M. Ashfaq. 2015. Margins and determinants of rice export from Pakistan to UAE market. *Pakistan Journal of Agri. Sciences.*, 52(2):557-563.
- Katengeza, S. 2012. ICT-Based Market Information Services, Operational Environment and Performance: The case of Malawi Agricultural Commodity Exchange and Food Nutrition Security Joint Task Force. *American International Journal of Social Science*, 1(2): 34-43. Available at: http://www.aijssnet.com/journals/Vol_1__No_2__December_2012/4.pdf.
- Kizito, A.M. 2011. The structure, conduct, and performance of market information systems in sub-Saharan Africa. Michigan State University, East Lansing, MI, USA (Ph.D. Thesis). Available at: https://etd.lib.msu.edu/islandora/object/etd%3A1583/datastream/OBJ/download/The_structure__conduct__and_performance_of_agricultural_Market_Information_Systems_in_Sub-Saharan_Africa.pdf.
- Larson, J., and D. Varangis, P. 2001. Commodity Market Reforms: Lessons of Two Decades. World Bank regional and sectoral studies. World Bank Publication: Washington, DC. Available at: <https://openknowledge.worldbank.org/handle/10986/13852>.
- Mabota, A., P. Arlindo, A. Paulo and C. Donovan. 2003. Market Information: A Low Cost Tool For Agricultural Market Development? Flash Series No. 37E. Results of Research from SIMA-DEST and Department of Policies Analysis, MADER-Directorate of Economics. Maputo. Available at <http://ageconsearch.umn.edu/bitstream/55235/2/flash37e.pdf>.

- Mawere, J. 2008. Agricultural Marketing Information and Maize Marketing in Zambia: A survey of Kabwe District in the Central Province of Zambia. The Copperbelt University, Copperbelt, Zambia (MBA Thesis). Available at: [http://dspace.cbu.ac.zm:8080/jspui/bitstream/123456789/148/1/MAWERE, % 20 JOSHUA 000 1 % 20 - % 20 Agricultural%20marketing%20information%20and%20maize%20 marketing%20in%20Zambia. PDF](http://dspace.cbu.ac.zm:8080/jspui/bitstream/123456789/148/1/MAWERE,%20JOSHUA0001%20-%20Agricultural%20marketing%20information%20and%20maize%20marketing%20in%20Zambia.PDF).
- Mawazo, M.M., K. Michael and J. Ko. 2014. Agricultural Market Information Services in Developing Countries: A Review. ACSIJ Advances in Computer Science: an International Journal, 3(9):38-47. Available at: <http://www.acsij.org/documents/v3i3/ACSIJ-2014-3-3-415.pdf>.
- Mendoza, G. 2006. Evaluation study of "best practices" in agricultural marketing information systems, AMIS. Market Information Organization of the Americas (MIOA) Publication. Available at: <http://www.mioa.org/assets/MIS/OIMA-Best-practices-report.pdf>.
- Mukhebi, A. and J. Kundu. 2014. Linking farmers to markets in Kenya: The evolving KACE model. Cahiers Agricultures, 23:282-7. Available at: <http://www.cahiersagricultures.fr/articles/cagri/pdf/2014/04/cagri2014234-5p282.pdf>.
- Santosh, B.B., B. Pandab, R. Ashish, B.N. Narayan, C.B. Anama and S. Jenaf. 2015. Information communication technology promoting retail marketing in agriculture sector in India as a study. Procedia Computer Science, 48: 652 – 659.
- Shepherd, A.W. & A.J.F. Schalke. 1995. An Assessment of the Indonesian Horticultural Market Information Service. AGSM Occasional Paper No. 8. FAO Publication: Rome. Available at: http://www.fao.org/fileadmin/user_upload/ags/publications/INDONMIS.pdf.
- Shepherd, A.W. 1997. Market Information Services: Theory and Practice. AGS Bulletin. FAO Publication: Rome. Available at: <http://www.fao.org/3/a-x6993e.pdf>.
- World Bank. 2011. ICT in Agriculture: Connecting Smallholders to Knowledge, Networks and Institutions. E-sourcebook (See, in particular, Module 9). World Bank Publication: Washington, D.C. Available at: <http://documents.worldbank.org/curated/en/455701468340165132/pdf/646050ESW0P11801ture0e0Sourcebook12.pdf>.
- Zoltner, J. & M. Steffen. 2012. An Assessment of Market Information Systems in East Africa. USAID briefing paper. Available at: http://agrilinks.org/sites/default/files/resource/files/An_Assessment_of_Market_Information_Systems_in_East_Africa.pdf. om/media/cases/Ghana_Esoko_2010.pdf.

S. No	Name of author	Contribution	Signature
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2	Nadia Nasir	Assisted in methodology section and interpreted the results	
3	Chaudhry Abdul Rehman	Computed the idea	
4.	Muhammad Usman	Helped in designing	